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ABSTRACT

Three studies investigated goal expectancy as a variable in teaching-learning situations. The first study looked at the effect of the student's expectancy of the type of test to be given on their ability to recall word lists. There was a strong type-of-test expectancy effect in that those persons expecting to recall words in any sequence actually recalled more words, but fewer words in the presented sequence, than those who expected to recall words in serial order. A second study investigated the effects of different recall intervals under notetaking and no-notetaking conditions on the immediate and delayed recall of instructional material. The results of the study imply that notetaking has little value in situations in which written instructional materials are presented and the notes taken cannot be used in later review. A third study hypothesized that positive and negative experimenter attitudes would demand characteristic functions affecting subject performance on an experimental task, and that experimenter attitude would have a greater effect when subjects were given more time to study. It was found that the attitude of the experimenter had no overall effect on recall. Those subjects who were allowed extra time for study retained more of the information than those subjects who were allowed less time. (JY)

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GOAL EXPECTANCY AS A VARIABLE IN TEACHING LEARNING SITUATIONS.

Section III, Instructional Strategies: Multivariable Studies of Psychological Processes Related to Instruction.

EM 007 811

Summary

Type-of-Test Expectancy Effects on Learning of Word Lists and Prose Passages

Nicholas M. Sanders and Ovid Tzeng

Technical Problem

Students say they prepare for an essay type of test by studying interrelationships, while they prepare for objective tests by studying for specifics without regard to interrelationships. Empirical research has not convincingly demonstrated differences between the essay and/or objective test scores of learners preparing for essay tests and learners preparing for objective tests. The two studies reported here provided for more rigorous investigation of the effects of type-of-test expectancy with word lists and logically structured prose paragraphs.

General Methodology

In both investigations subjects studied and then were tested on three sets of materials. The materials in the first study were three 40-word lists, and in the second study the materials were three, seven-sentence paragraphs. Subjects were led to expect a test on either specific words (or sentences) or interrelationships among the specifics - serial order of words in first study and logical implications of sentences in the second study - by being appropriately instructed before studying each set of materials and by taking the respective type

of test on the first two sets of materials. The major criteria were performances on tests for both types of learning (specifics and interrelationships) after studying the third set of materials.

Technical Results

There were strong type-of-test expectancy effects in the first study, with those persons expecting to recall words in any sequence actually recalling more words, but fewer words in the presented sequence, than those who expected to be required to recall words in serial order. In the second study there were no overall type-of-test expectancy effects. Instead, each of the three prose passages used resulted in a different relationship between performances on the two types of tests as a function of which type of test was expected.

Implications for Education and for Further Research

The difference in findings in the two studies may have been due to the extent to which appropriate preparation for the two types of tests conflicted with one another. If this explanation is appropriate, then these studies would imply that for most educational objectives one would anticipate no type-of-test expectancy effects.

However, another interpretation of the different findings in the two studies is that type-of-test expectancy effects are manifest with recall measures (as in the first study) but not with recognition measures (as in the second study). If this second interpretation were correct, there would be educational implications for recall measures, though not for recognition measures.

Thus, further research should be carried out to resolve the issue, most likely by using recall measures (as in the first study) with prose passages (as in the second study).

Type-of-Test Expectancy Effects on Learning of Word Lists and Prose Passages

Nicholas M. Sanders and Ovid Tzeng

Students have reported that they study differently for different types of examinations (Douglass & Talmadge, 1934; Meyer, 1935; Silvey, 1951; and Terry, 1933). In general, they say they attempt to master specific details for objective tests and more comprehensive interrelationships for essay tests. However, studies in which the type of test anticipated has been experimentally manipulated have often not revealed any differences in learning outcomes (Hakstian, 1971; Vallance, 1947; and Weener, 1971). While Meyer (1934, 1936) was able to demonstrate learning outcome differences, the subjects in his studies were informed that they should study for a particular type of test and should not study for other types. Thus, a strong explicit demand for differences was possibly instituted in his studies. One other study (Sax & Collet, 1968) revealed that subjects expecting a "recall" test on applications did more poorly on a multiple-choice test of applications than did those expecting a multiple-choice applications test. However, Sax and Collet's "recall" condition subjects were older than their multiple-choice subjects, and age may be an index of several variables of importance in test taking behavior (Hakstian, 1971).

Though the conclusion that would seem to be implied from the available research is that there are no type-of-test expectancy effects

on learning outcomes, the criteria used in the studies have never allowed for a comparison of outcomes in accordance with the student's claims concerning their study behavior. That is, the criterion tests have not been designed to compare knowledge of specifics and knowledge of inter-relationships. If essay test scores are partially determined by the presence of specific points (as is often doen to increase the inter-rater reliability) or if some of the objective test items measure inter-relationships among specifics by including distractors pertaining to other specifics in the material covered, the comparison of the scores on the tests of different format may reveal no differences. The purpose of the present studies is to determine whether expectation of a test on specifics will produce different learning outcomes from an expectancy of a test on interrelationships without regard to the usual distinctions of test format.

The first study represents a well-defined and controlled attempt to demonstrate type-of-test expectancy effects. Students studied word lists and were led to expect either a test on knowledge of specific words or a test on knowledge of interrelationships among the words. The conceptual basis for predicting test expectancy effects stem from some research in human memory. Tulving (e.g., 1964) and others have demonstrated that subjects asked to recall as many words as possible from a list of words engage in a process of regrouping the words. This process is called subjective organization, to indicate that the learner groups the words in a way most meaningful to himself. If memory for as many details as possible were the desired outcome of studying, subjective organization would be appropriate. However, if the desired outcome were memory of the words in the organization as presented,

subjective organization might be antithetical to that goal. Type-of-test expectancy effects should therfore be manifest with these contrasting relevant study procedures, if the learner is capable of modifying his or her study procedures on the basis of the knowledge of which type of outcome is desired.

Experiment I

Method

Subjects. Thirty students enrolled in an introductory educational psychology course volunteered to serve as subjects and received extra grade credits in the course for their participation in the experiment. The subjects were administered the experiment in individual sessions, and were assigned to treatment conditions in an alternating fashion in the order in which they appeared for the session.

Materials. Three non-overlapping word lists were used in the study. Each list contained 40 words that were selected from eight categories, randomly chosen from the norms of Battig & Montagne (1969). Five words were chosen from the sixth to the eleventh response frequency ranks of each category. The words in each list were presented typed in a single vertical order down the center of a page of white typing paper, and were sequenced in a random order, with the restriction that no word followed another word from the same category.

A crossword puzzle, which was used as an interference task, involved 24 target words, each of which was drawn from the twelfth through twentieth response frequency ranking of each of the 24 categories used in the word lists. The cue phrase for target word was the corresponding

category name. The puzzle was presented on a sheet of typing paper, with the cue phrases on the lower half of the page.

Procedure. All subjects were given four minutes to study each of the three word lists and were tested for recall immediately after the study of each list. The order of presentation of lists was counterbalanced so that one-sixth of the subjects had each one of the possible six sequences of the three lists.

Approximately one-half of the subjects in each list order condition were assigned to a free recall expectancy (FRE) treatment. These subjects were instructed prior to the study of first and second word lists that they were to remember as many words as possible. The instructions for the first two recall lists indicated that recall could be in any order in which they recalled the words, and the response sheet provided for the test was divided into a six by eight set of rectangles, which was designed to indicate to the subject that order of recall was unimportant. The subjects were allowed five minutes for the recall test.

The other subjects were assigned to a serial recall expectancy (SRE) treatment. These subjects were informed that they were to recall as many words as possible in the order in which they appeared on the stimulus list. The tests for their first two lists were preceded by instructions to recall the words in the presented order, and the response sheets for this group had two vertical columns of lined blanks with clear indications of which blank was to be used for recording the first word and how to continue recording words in the order the subjects recalled the words as having been presented. These subjects were also allowed five minutes for the recall test.

The instructions for study of the subject's third list were the same as they had been for the previous two lists, but upon completion of the study period all subjects were given both types of recall sheets and were instructed to recall both as many words in any order and as many words in serial order as they could. Recall time allowed for the third list was six minutes.

All subjects were then given ten minutes to work on the crossword puzzle described above in the materials paragraph. This task was designed to interfere selectively with the retention of subjects who had utilized category organization of the words to facilitate memory. To determine whether the anticipated interference occurred, subjects were retested for both free recall and serial recall of their third word list. Six minutes were again allowed for recall.

Each free recall response sheet was scored for the total number of words recalled. The serial recall sheets were scored by allowing one point for each word correctly following a preceding word; also, one point was allowed if a subject recorded the first word in the list on the designated line of the response sheet.

Results

Practice effects. To determine whether subjects recalled more on later lists than on earlier ones, a single-factor, repeated measures analysis of variance design was used. An F (2,28) = 6.82, $p < .01$ was computed for the practice effect on free recall (with FRE subjects only), while F (2,28) = 4.90, $p < .05$ was found for the analysis of serial recall data with SRE subjects only. The corresponding means and standard deviations are presented in Table 1, in which the constant

Table 1

Means and Standard Deviations of Two Types of Recall Scores

On First, Second and Third Word Lists[a]

Recall Type	Word Lists		
	First	Second	Third
Free Recall	26.7 (5.82)	28.5 (5.43)	31.0 (4.13)
Serial Recall	11.7 (6.06)	14.6 (5.21)	16.5 (6.85)

[a] Standard deviations are in parentheses.

improvement of recall from first list to last list is demonstrated for both free recall and serial recall. These effects may be due to warm-up and/or to the development of an expectation of, and consequent preparation for the particular type of recall test.

Treatment effects. Table 2 presents the means and standard deviations of free recall performances as a function of type of test expected and the within subjects variable, time of testing. The same statistics are given in Table 3 for the serial recall criterion. In addition to the two levels of test expectancy and the two testing times, the three word lists were included in a 2 x 3 x 2 mixed analysis of variance. Two such analyses were made, one for the free recall data and one for the serial recall data.

In both analyses type-of-test expectancy was a significant factor with F (1,24) = 59.12, $p < .001$ for the free recall measure, and F (1,24) = 92.98, $p < .001$ for the serial recall measure. Both differences were in the expected direction, with FRE producing superior free recall performances are SRE resulting in superior serial recall scores.

The time of testing, a repeated measurement, resulted in an F (1,24) = 6.90, $p < .05$, for free recall, and an F (1,24) = 4.12, $p < .10$, for serial recall. However, the interaction between type-of-test expected and time of testing was significant using free recall scores (F [1,24] = 8.12, $p < .01$), but not significant with the serial recall data (F [1,24] < 1.00). The nature of the interaction with the free recall measure was as expected: a greater loss in memory occurred in FRE than in SRE. The nature of the interaction using free recall scores and the lack of an interaction using serial recall scores indicates that

Table 2

Free Recall Means and Standard Deviations

As a Function of Type of Test Expected[a]

Type of Test Expected	Time of Testing on Third List	
	Immediate	After Ten Minutes Work on the Crossword Puzzle
Free Recall	30.6 (4.33)	28.6 (4.96)
Serial Recall	21.6 (5.86)	21.6 (5.82)

[a] Standard deviations are in parentheses.

Table 3

Serial Recall Means and Standard Deviations

As a Function of Type of Test Expected[a]

Type of Test Expected	Time of Testing on Third List	
	Immediate	After Ten Minutes Work on the Crossword Puzzle
Free Recall	2.9 (1.94)	2.3 (1.91)
Serial Recall	17.5 (6.98)	16.2 (6.64)

[a] Standard deviations are in parentheses.

the particular crossword puzzle task used interfered with subjective organization but not serial organization, and thereby demonstrates a source of interference when details are subjectively organized in memory.

Word lists were studied to determine the generalizability of findings across different materials. For the free recall data, the list main effect (F [2,24] = 2.19), the list X test expectancy interaction (F [2,24] = 2.00), and the list interactions involving time of testing (both F's [2,24] < 1.00) were not significant. List effects were revealed with the serial recall measure (F [2,24] = 3.72, p < .05), and the interaction between lists and type-of-test expectancy was significant (F [2,24] = 6.66, p < .01). However, the nature of these effects on the serial recall measures were not such as to qualify the type-of-test expectancy findings; the serial recall means for the three lists in the FRE being 1.8, 2.1, and 4.1, while the respective means in the SRE were 14.3, 21.6, and 11.4. There were no list interactions involving time of testing with the serial recall data; both relevant F's were less than 1.00.

Experiment II

Experiment I demonstrated that expectation of, and consequent preparation for, a particular type of test is a potent variable. In contrast to many of the previous research studies, analysis of the two types of tests involved allowed for a definitive conceptualization of the conflicting requirements of the two types of tests; one type allowed for reordering of words in recall (subjective organization), whereas the

other type (serial recall) actually prevented any reordering. The subjects initially seemed to understand this, and with practice became more proficient at producing the outcome appropriate to each type of test.

The second experiment was an attempt to extend the findings of the previous experiment to materials more similar to school materials; instead of word lists, prose paragraphs were used. In this second experiment, the specifics that subjects were led to expect on the test were particular assertions made explicitly in sentences in the paragraphs. The interrelationship type of test was constructed from logical implications of sentences in the paragraphs and never were these questions answerable by reference to any single sentence presented.

In this experiment the two types of tests would seem to be differentiable as two levels of a hierarchy, with the knowledge of interrelationships among specifics being based on knowledge of the specifics. Of course, knowledge of specifics would not require knowledge of interrelationships among the specifics. However, it is possible that the learner who expects an interrelation type of test might forget the component specifics after mastering the interrelationships among them. And it is also possible that the learner expecting a specific test might be able to deduce the interrelationship between specifics as he or she confronts the unexpected question on the test. While this second experiment does not allow for a conceptual presentation of a clear conflict between different test expectancies, it is the type of experiment required for further definition of the type-of-test expectancy effect in the educational setting.

Method

Subjects. Sixty students from an introductory educational psychology course volunteered to serve as subjects and received extra grade credits in the course for their participation in the experiment. The subjects were randomly assigned to treatment conditions.

Materials. Three, seven-sentence paragraphs were selected as fulfilling three requirements. First, the content of the paragraphs was fictional, and therefore the likelihood of different knowledge backgrounds of subjects affecting their performance was decreased. Second, a rough comparison of the present study and other similar research was enabled by using two paragraphs Frase (1969, 1970) has studied. Finally, four of the seven sentences in each paragraph enabled logical deductions beyond the specific information explicitly presented. A brief specification of the structure of the critical four sentences can be described from an example, one of the paragraphs used in the present study, entitled "Survey on the Use of Reolam:"

> Reolam is a new, commercially marketed product. A recent survey has indicated that people who buy Reolam live on the north side of town. It is a well-known fact that the north side of town is a high pollution area. The City Council has been studying the characteristics of areas that produce considerable pollution. They have found that people in these areas are very cleanly. The research includes many new findings. One is that cleanly people prefer light colors instead of dark ones for furniture.

The paragraph includes four assertions about five classes of people: 1. Those who buy Reolam (A) are those who live on the north side of town (B). 2. Those who live on the north side of town (B) are those who live in a high polluation area (C). 3. Those who live in a high pollution area (C) are those who are very cleanly (D). 4. Those who are very cleanly (D) are those who prefer light colors instead of

dark ones for furniture (E). These four assertions about the classes may be logically expressed as: A is contained in B, B is contained in C, C is contained in D, and D is contained in E. The remaining three sentences do not assert any type of logical relationship, and are assumed to serve as fillers.

The two other paragraphs used have the same structure, and are entitled "Astronomical Discoveries" (Frase, 1970) and "The Fundalas of Central Ugala" (Frase, 1969). The Fundalas paragraph was rearranged for the present study so that, as with the other two paragraphs, the sequence of relationships presented was from least inclusive to most inclusive.

Two sets of eight true-false test items were constructed for each paragraph. One set, referred to as reproductive by Frase (1970), consisted of items concerning relationships directly expressed in the paragraph. Four of these were true (e.g., the sentences assering A contained in B and C contained in D), and four were false (e.g., the sentences asserting B contained in A and D contained in C). The other set included items based on deductive reasoning, called productive by Frase (1970). Of the six possible valid inferences, four were randomly chosen for each paragraph (e.g., the sentences asserting A contained in C and B contained in E). The four corresponding invalid inferences (e.g., the sentences asserting C contained in A and E contained in B) were used as false items.

Procedure. The materials along with instructions were presented in typed form in a loose-leaf binder. Each binder contained the three paragraphs with the test items immediately following the corresponding paragraph. Each test item was presented on a separate page, to prevent

subject's comparison of questions and his or her previous answers. The sequence of items was randomly determined for each paragraph. All answers were recorded on a single response sheet not included in the binder.

The subjects were informed that they were to consider each page for as long as they chose, but not to look back to previous pages or to look forward until they were ready to proceed to the next page. One-sixth of the subjects read the three paragraphs in each of the possible six orders.

One-half of the subjects in each paragraph order condition read, prior to each paragraph, a study hint which suggested that the nature of test items would be specific (reproductive) and were given examples of a valid and an invalid item, based on two sentences unrelated to any of the paragraphs. The subjects in this condition, reproductive test expectancy (RTE), also saw only reproductive type items on the first two paragraph tests.

The other subjects read study hints prior to each of the three paragraphs that indicated, in a similar manner as described above, that test items would be of the productive type. Only productive items were included in their tests on the first two paragraphs. This condition is the productive test expectancy (PTE) condition.

After reading their third paragraph, all subjects were given both productive and reproductive test items, arranged in random order. These two types of items were scored separately for analysis. For comparability with the Frase (1969; 1970) studies, the scoring procedure entailed subtracting the proportion of invalid items called valid (false alarms) from the proportion of valid items called valid (hits).

The experiment was administered in a large room, with provisions made for up to six subjects to work independently. Since the epxeriment was subject-paced, a difficult crossword puzzle was included after the third paragraph items to allow all subjects to complete the experiment before any subject left the room. Completion time for the experiment itself varied from about 10 minutes to about 35 minutes.

Results

Practice effects. In contrast to the previous experiment, subjects performed no better on later tests than on earlier ones. The related F (2,58) for the reproductive items (using RTE subjects only) was 1.34 ($p > .10$), while for the productive items F (2,58) < 1.00. Thus, there is no evidence for the gradual development of type-of-test expectations.

Treatment effects. A 2 x 3 x 2 mixed analysis of variance was computed for comparing the two levels of test expectancy, the three paragraphs, and two levels of the within subjects variable, reproductive versus productive test items. The results of this analysis are presented in Table 4.

In contrast to the previous study, there was no interaction of type-of-test expected with type of test items. The significant triple interaction indicates that the paragraphs manifest distinctly different relationships between type of test expected and type of test item. The relevant means for the triple interaction are presented in Table 5. The paragraph on "Astronomical Discoveries" revealed no relationship between the type of test expected and the type of test item, while the "Reolam" paragraph yielded results contrary to those expected. Only the passage on "The Fundalas" produced the expected direction of interaction,

Table 4

Summary of the Analysis of Variance of Reproductive and Productive Test Item Performances

Source	df	MS	F
Between Subjects	59		
Type-of-test expectancy (A)	1	.0021	< 1
Paragraphs (B)	2	.8187	6.08**
A x B	2	.0152	< 1
Error	54	.1346	
Within Subjects	60		
Type of test (C)	1	.2521	4.46*
A x C	1	.0187	< 1
B x C	2	.2239	3.96*
A x B x C	2	.2063	3.65*
Error	54	.0565	

* $p < .05$

** $p < .01$

Table 5

Mean Proportion Score for Reproductive and Productive Test Items as a Function of Type-of-Test Expected and Paragraphs Studied[a]

Treatment Variables		Criterion Variables	
Paragraph Studied	Type-of-Test Expected	Reproductive Test Items	Productive Test Items
"Astronomical Discoveries"	Reproductive	.22	.00
	Productive	.20	.00
"Reolam"	Reproductive	.30	.28
	Productive	.42	.18
"Fundalas"	Reproductive	.45	.35
	Productive	.25	.50

[a] Scores were assigned by subtracting the proportion of invalid items called valid from the proportion of valid items called valid.

with more reproductive items correct with RTE than PTE and more productive items correct for PTE subjects than for RTE subjects.

Though the type of test item produced a significant effect, that effect is also contingent upon the paragraph used. From Table 5 one may discern that the reproductive items were easier than the productive ones for all paragraphs except the one on the "Fundalas", which yielded a productive item mean higher than the reproductive item mean.

Discussion

Type-of-test expectancy produced no significant effects in Experiment II. Neither was there any evidence that subjects became more proficient with either reproductive or productive test items as a function of prior experience. The potent variable in this experiment was the materials variable. Not only did the paragraphs differ in overall difficulty, they also produced markedly different patterns of relationships between the type of test expected and the type of test given. Only with one paragraph was there a tendency for better performance on the type of test expected, and subjects studying one of the two other paragraphs tended to perform worse on the type of test expected.

Unfortunately, there are no readily available dimensions along which to compare the paragraphs in ways that might clarify their effects in the second experiment. However, it is important to note that the studies by Frase (1969; 1970) and the first study presented in this report did produce strong effects over and above any effects the materials may have had. Why were the test expectancy effects so strong

in the previous study and so weak and affected by the materials variable in the present study?

One of two factors possibly leading to different test expectancy effects in the first and second experiments reported here is the extent to which preparation for one type of test conflicted with being prepared for the other type test. In the first study there was a direct conflict: Remembering the serial order of the words prevented the subjective reordering of words into categories that would have allowed for remembering more words, while the subjective reorganization according to category clusters certainly prevent memory of the serial order of the words. In the second study there was no clear conceptual basis for conflict of expectancies on performance: Studying for the productive type test items would require detailed consideration of the specific sentences, while the learner who had remembered the specific sentences could deduce answers to the productive type items as those items were encountered on the test. If conflict between the type of preparation needed for the types of tests - as described above - is a prerequisite for type-of-test expectancy effects, then the occasions in educational settings where one would postulate such dramatic conflict would be very few if any. Based upon this analysis, the type-of-test expected should not strongly affect learning in the overwhelming majority of educational settings.

However, a procedural distinction between the studies could have resulted in the differences in findings: the type of memory measure used. In the first study, subjects were required to <u>recall</u> words, while in the second study subjects were asked to <u>recognize</u> valid statements. Usually recognition measures are considered to indicate a more surface level

of memory than recall measures. Thus, the difference in results might be interpreted to mean that type-of-test expectancies affect only the deeper levels of memory and processing. If this were the correct interpretation of the differences in findings, then the expectancy of tests of specifics or expectancy of a test of interrelationships would be an extremely important variable for educators to consider.

The resolution of these two basically different interpretations of the different findings in the two studies reported here requires additional empirical research. While the first interpretation is more consonant with the issues as they were conceptualized in this report, the consideration of the type of memory measure used has been very important in research on learning and memory. Studies employing recall measures as criteria for type-of-test expectancy effects with prose passage materials should provide an answer to the issue raised by the present studies.

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25

Summary

The Effects of Recall Interval Expectancy and Note Taking On Immediate and Delayed Retention

Paul Weener and Sam Rock

Technical Problem

This study investigated the effects of different expected recall intervals under note taking and no note taking conditions on the immediate and delayed recall of instructional material. It was hypothesized that different test interval expectancies influence note taking activities and the recallability of instructional materials. The general rationale for the research is that students modify their overt and covert study activities depending on the length of the expected interval between study and the criterion test, and that the manipulation of these expectancies will influence the learning outcomes.

General Methodology

Eight different experimental conditions were created by completely crossing three two-level factors: (1) note taking - no note taking; (2) immediate test expectancy - delayed test expectancy; (3) immediate test - delayed test. Groups of four to eight subjects participated in the experiment. Each of the subjects was presented with instructions which stated that he was to read and study a short article, that he could or could not take notes, and that he would be tested immediately after studying or one week later. The material which was studied for

thirty minutes was a rather difficult passage dealing with principles governing the development of species.

Half of the subjects were tested both immediately and one week later; half were tested one week later only. The immediate test consisted of a free recall test and an essay test; the delayed test consisted of a free recall test, an essay test, and a multiple-choice test.

Technical Results

Scores were obtained on a free recall test, an essay test, and a multiple-chioce test for the eight experimental groups. In addition, the number of words of notes taken in the note taking groups was counted. No significant main effects for the test interval expectancy factor or the note taking factor were found on any of the three criterion tests. An interaction between expected test interval and actual test interval on the free recall test results supported the contention that students do modify their study behaviors depending on their expectancy of when the criterion test will be taken. In support of this contention subjects took about twice as many notes when they anticipated a delayed test as when they anticipated an immediate test even though they knew that they would not be able to use their notes at a later time.

The interaction between the test interval expectancy factor and the note taking factor was significant for the multiple-choice test results, and approached significance in the analysis of the free recall results. The implication of these findings is that note taking seems to interfere with the learning strategies employed by a person preparing for an immediate test, but seems to facilitate the learning strategies employed by a person preparing for a test in the future.

Educational Implications

The results imply that note taking has little value in situations in which written instructional materials are presented and the notes taken cannot be used in later review. The results further imply that the recallability of material at a later time is dependent on the expectancy that a learner had when he is studying the material. If recall of material is required at a time in the future the learner should be so informed in order that the necessary adaptive study behaviors can be employed.

Implications for Further Research

Replication is needed to determine the reliability of the effects observed. The research should also be expanded to include comparisons of situations in which review of notes is permitted and to situations in which material is auditorily presented.

The Effects of Recall Interval Expectancy and Note Taking On Immediate and Delayed Retention

Paul Weener and Sam Rock

The manner in which a student actively operates on visual or auditory stimulus materials in an instructional setting is dependent on his expectancies of when and in what form the information will have to be retrieved. The learner can select from a variety of information processing strategies depending on how he plans to use the information at a later time. Some tasks require the learner to focus on isolated bits of information and to store the presented information for a very brief period of time. Simple rehearsal processes may be adequate to fulfill the requirements of such a task. On the other extreme, some tasks require the learner to focus on broad, integrative principles and to recall the material months or even years later. Such a task would seem to require active transformational and coding processes which are, as yet, not well understood.

The learner's activities which intervene between the presentation of the instructional task and the student's performance on the criterion task are assumed to be adaptive behaviors which are influenced by the learner's perception of the desired criterion performance. We have called a class of student behaviors which intervene between instruction and criterion performance, student instrumental activities (Di Vesta, et al., 1970, p. 6). Instrumental activities are those activities which

are learner initiated or directed, and mediate between the instructional demands and the learning outcomes. Covert forms of instrumental activities include silent rehearsal, evoking images, constructing mnemonics or verbal associates. The most common forms of overt instrumental activities are note taking and verbalizing. It is likely that the student's expectancy of when presented material will have to be retrieved will influence his instrumental activity which in turn will determine what can be remembered after given intervals of time. Note taking, verbalizing, imaging and other instrumental activities influence what and how much can be remembered at a later time.

The purpose of the present research is to determine the effects of note taking and expected recall interval on both immediate and delayed recall of instructional material. Berliner (1970) reviewed the experimental research on the effects of note taking in instructional settings and concluded that the evidence "is not favorable regarding the utility of note taking" (p. 2). Recent research by Di Vesta and Gray (1971) and Peters and Harris (1970) showed beneficial learning effects associated with note taking activities in experimental instructional settings. It is hypothesized that different expectancies will result in different note taking activities and that the test interval expectancy will also influence how much is remembered.

Method

Experimental Design

Eight different experimental conditions were created by completely crossing three two-level factors: (1) immediate test expectancy, delayed test expectancy; (2) immediate test, delayed test; (3) note taking, no

note taking. The immediate test was given to the subjects immediately after they had read the assigned material; the delayed test was given one week later.

Subjects

The subjects were 164 students from the introductory educational psychology course at The Pennsylvania State University who received course credit for their participation in the experiment.

Materials

The instructional material was a five-page passage titled, "The Origin of Species," dealing with the principles governing the development of species. A multiple-choice, essay, and free recall test were used as criterion measures. The multiple-choice test consisted of sentences taken directly from the instructional passage with key words deleted and four alternatives from which to choose. The essay questions were rather specific, referring to the main ideas in the passage, e.g., "What are the two basic conditions ... necessary for the evolution of distinct species?" The free recall task consisted of the instruction to "Write down as much as you can remember about the passage, 'The Origin of Species'."

Procedure

Subjects were recruited and participated in groups of four to eight. Each of the subjects was assigned randomly to one of the eight experimental conditions. The subjects were seated at a large table which was partitioned into eight cubicles so that the subjects were separated from one another. In each cubicle was the instruction sheet

appropriate to that subject's treatment condition and the "Origin of Species" reading material. For those subjects in the note taking conditions, a yellow pad and pencil were provided.

After the subjects were seated the experimenter gave brief instructions to the effect that they would have two minutes to read the instructions and thirty minutes to study the task material. After answering questions, if any, the experimenter left the room and observed the subjects through a one-way mirror.

Each subject read the instruction sheet which corresponded to the treatment group to which he was assigned. Each set of instructions was basically the same in format, each differing only with respect to the time at which the criterion test would be administered and whether or not note taking was permitted. The free recall and essay criterion tests were briefly described on the instruction sheet. The subjects' understanding of the key parts of the instructions was checked with three questions following the instructions. All subjects in the note taking conditions were informed that they would not be able to use their notes at the time of the test.

At the end of the 30 minute study period the experimenter re-entered the room and collected the instruction sheets, and any notes that the subjects had made. The subjects in the delayed test conditions were dismissed and instructed to return one week later for the test. The subjects in the immediate test condition were given the free recall and essay tests at this time. In the free recall test, the subjects were instructed to write down as much as they could remember in ten minutes. They were then given three essay questions and twelve minutes to answer them. After completing the essay test, they were told to

return one week later for the second part of the experiment. Although the subjects in the immediate condition had been told they would receive an immediate test the request to return one week later came as no surprise to them because the experiment had been described as a two part experiment when they signed up for participation.

When the subjects returned one week later they were again seated in the same experimental room and given the same free recall and essay tests. For the subjects in the immediate test condition this was their second time taking these tests, but for subjects in the delayed test conditions this was the first and only time they would take these tests. After finishing the free recall and essay tests all subjects were given a 20-item multiple-choice test and 15 minutes in which to complete it. All time limits for tests were sufficient to provide no time restrictions on performance. After the multiple-choice test, they were given a brief post-experimental questionnaire which asked about the credibility of the experimental conditions and whether or not they had discussed the experiment with anyone.

Scoring

The score on the multiple-choice test was the number of correct responses. A scoring guide which listed the important parts of the answer to each essay question was used to score the essay responses. One point was awarded for each statement in the answer which coincided with the parts of the answer provided on the scoring guide. The free recall tests were scored for number of correct statements made. Each independent clause in the response on the free recall protocol was scored correct or incorrect and the total score represented the number of correct statements made.

Results

The means and standard deviations for the free recall and essay tests are given in Table 1. A 2 x 2 x 2 analysis of variance was carried out to test the simple and interactive effects of expected test interval, actual test interval, and note taking conditons. Separate analyses were done using the free recall and the essay test scores as dependent measures.

The analysis of scores on the free recall test indicated no significant main effects due to test interval expectancy, F (1,156) = .17, $p > .05$, a significant main effect due to actual test interval, F (1,156) = 83.38, $p < .01$, and no significant effect due to note taking, F (1,156) = .65. There was a significant interaction between the expected recall interval and actual recall interval factors, F (1,156) = 5.22, $p < .05$. None of the other interactions were significant.

To further analyze the interaction effect, simple effects analyses were done on the expected recall interval factor. The mean for the immediate test was greater in the immediate test expectancy condition ($\bar{X}$ = 6.15) than in the delayed test expectancy condition ($\bar{X}$ = 5.27), but not significantly so, F (1,76) = 3.58, $p > .05$. The mean for the delayed test was greater in the delayed test expectancy condition ($\bar{X}$ = 3.04) than in the immediate test expectancy condition ($\bar{X}$ = 2.43), but again the difference was not significant, F (1,76) = 1.72, $p < .05$.

The analyses of scores on the essay test indicated no significant main effect due to test interval expectancy, F (1,156) = .86, $p > .05$,

Table 1

Means and Standard Deviations for Free Recall and Essay Test Scores

For Eight Experimental Groups

Expected Recall Interval	Actual Recall Interval	Test	Note Taking Condition: No Notes Mean	No Notes SD	Notes Mean	Notes SD
Immediate	Immediate	Free Recall	6.45	2.87	5.84	2.34
		Essay	4.70	3.20	5.37	2.85
	Delayed	Free Recall	2.90	2.21	1.95	1.29
		Essay	2.81	1.78	1.86	1.81
Delayed	Immediate	Free Recall	4.74	2.10	5.80	2.19
		Essay	4.89	3.09	5.60	3.77
	Delayed	Free Recall	3.32	1.84	2.76	1.51
		Essay	2.86	2.03	2.90	1.87

a significant effect due to actual test interval, F (1,156) = 38.11, $p < .01$, and no significant effect due to note taking, F (1,156) = .08, $p > .05$. None of the interactions were significant.

Table 2 presents the multiple-choice test results. It should be noted that only a delayed multiple-choice test was given. Due to time the multiple-choice test could not be given as an immediate test. Therefore, the mean scores presented in Table 2 for the immediate test condition are the mean scores for those groups which took the free recall and essay test immediately. But all multiple-choice test scores were obtained one week after the study session.

A 2 x 2 x 2 analysis of variance was carried out on the multiple choice test results. The main effect due to test interval expectancy was not significant, F (1,156) = .66, $p > .05$; the main effect due to actual test interval was significant, F (1,156) = 10.75, $p < .01$; the main effect due to note taking was not significant, F (1,156) = .14, $p > .05$. The only significant interaction was between test interval expectancy and note taking, F (1,156) = 9.86, $p < .01$.

A test on the simple effects related to the significant interaction indicated that the mean score for the no notes condition ($\bar{X}$ = 9.80) was significantly higher than the mean score for the notes condition ($\bar{X}$ = 8.26, F (1,76) = 6.00, $p < .01$, in the immediate test expectancy condition. In the delayed test expectancy condition, the mean score for the no notes condition ($\bar{X}$ = 9.28) was greater than for the notes condition ($\bar{X}$ = 8.07) but not significantly so, F (1,76) = 3.70, $p > .05$.

In order to analyze the effects of test interval expectancy on note taking behavior, an analyses was carried out on the number of notes taken during study in the note taking conditions. The means and standard

Table 2

Means and Standard Deviations of Multiple-Choice Test Scores

For Eight Experimental Groups (Delayed Test Only)

Expected Recall Interval	Actual Recall Interval	Note Taking Condition: No Notes Mean	No Notes SD	Notes Mean	Notes SD
Immediate	Immediate	10.75	2.20	9.16	3.42
	Delayed	8.86	2.97	7.36	2.57
Delayed	Immediate	8.68	3.38	9.70	3.26
	Delayed	7.45	2.65	8.86	1.81

deviations for number of lines of notes taken in each of the four note taking experimental conditions is presented in Table 3. A 2 x 2 analysis of variance indicated a significant main effect due to test interval expectancy, $\underline{F}$ (1,76) = 19.6, $\underline{p} < .01$. The main effect due to the actual test interval was not significant, $\underline{F}$ (1,76) = 1.2, $\underline{p} > .05$, nor was the interaction between the two factors significant, $\underline{F}$ (1,76) = .28.

Discussion

The test interval expectancy factor did not emerge as a significant main effect in any of the three analyses. Note taking was influenced by the test interval expectancy, with subjects in the delayed test expectancy condition taking almost twice as many notes as in the immediate test expectancy condition. In a previous research study, (Weener, 1970) using the same instructional materials, subjects in the immediate expectancy condition scored significantly higher than the delayed expectancy subjects on an essay test. In that study also, the delayed expectancy subjects took almost twice as many notes as in the immediate expectancy condition. This latter finding must be interpreted in light of the fact that the subjects were instructed that they would not be able to use their notes later. Obviously, subjects do modify their instrumental activity depending on when they expect to recall the presented instructional material, but in the present research the increased note taking activity was not significantly associated with performance levels on any of the three dependent measures.

The interaction between the test interval expectancy factor and the note taking factor was significant for the multiple-choice test results ($\underline{p} < .01$), and approached significance in the analyses of the free

Table 3

Means and Standard Deviations for Number of Words of Notes Taken in Four Note Taking Conditions

Expected Recall Interval	Actual Recall Interval: Immediate Mean	Immediate SD	Delayed Mean	Delayed SD
Immediate	87.2	64.7	97.05	69.24
Delayed	155.4	90.17	183.8	86.3

recall results (F = 2.52, p = .12). When subjects were expecting an immediate test, those subjects who took notes did not do as well as those subjects who did not take notes. On a recognition task, such as the multiple-choice test, note taking apparently does not facilitate - and probably interferes with - the optimal learning strategies. When a person expects an immediate test, he probably scans as much of the material as possible with simple rote rehearsal being a dominant learning strategy. Note taking probably interferes with this activity and results in a decrement in recall performance when compared to the note taking conditions. When a person expects a test one week later with no opportunity for review in the interval, he probably recodes and transforms the data in order to make the information more resistant to forgetting. Note taking reinforces such instrumental activity. It can be argued that the function of most note taking activity is to recode and transform the data to make it more permanently imbedded in a person's cognitive structure. It is out of just such an awareness that subjects take many more notes when they expect a test several days or weeks in the future than when they expect a test within minutes after the completion of a task. In summary, note taking seems to interfere with the learning strategies employed by a person preparing for an immediate test, but seems to facilitate the learning strategies employed by a person preparing for a test in the future.

The interaction between expected test interval and actual test interval supports the hypothesis that subjects do modify their instrumental activities depending on when they expect to take a test on the material. Subjects who expected an immediate test did better on the free recall immediate test than those subjects who expected a

delayed test; subjects who expected a delayed test did better on the delayed test than those subjects who expected an immediate test. The instrumental activities facilitative of long term storage are not necessarily facilitative of "short time" storage, and vice versa, for the instrumental activities facilitative of short-time storage.

Note taking did not emerge as a significant main effect in any of the three analyses. This is contrary to the positive effects of note taking which were reported by Di Vesta and Gray (1971) and Peters and Harris (1970). The important difference between the present research and those two studies is that written stimulus materials were used in the present study and orally presented information was used in the other two studies. Note taking is apparently not as important an instrumental activity when the stimulus material is continually available for rereading as when the stimulus material is available for the duration of the subject's auditory memory span. If the material is presented orally and not written down or actively assimilated during the brief period that it can be held in short term memory, the material is irretrievably lost. In this situation, note taking becomes an important activity to facilitate the recoding and transforming of the data as well as to provide an external storage for later reference.

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Summary

Experimenter Attitude Effect and Subject Performance*

Study Director: Samuel K. Rock, Jr.

Advisors: Paul D. Weener and Nicholas M. Sanders

Technical Problem

Positive and negative experimenter attitudes were hypothesized to have demand characteristic functions (Orne, 1962) affecting subject performance on an experimental task. In particular, positive attitude was assumed to facilitate a subject's involvement in a learning task, while negative attitude was assumed to have a debilitating effect. It was reasoned that experimenter attitude would have a greater effect when subjects were given more study time and when subjects were tested on material directly related to specific study instructions (intentional material) than on incidental material.

General Methodology

In a laboratory setting, subjects were individually administered in sequence, a digit span task, a five-page prose passage learning task, and two tests, a free-recall test and a cued-recall test.

Half of the subjects were administered the tasks with the experimenter exhibiting a positive attitude, and the other half were

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* This study was conducted as a Master's thesis in the Department of Educational Psychology and was supported, in part, under the present contract.

administered the tasks with the experimenter exhibiting a negative attitude. The digit span task was used solely to provide extended exposure to the attitudinal behavior of the experimenter, and thus was not scored. In each attitude condition, half the subjects were allowed twice the length of time to study the prose passage as were the other subjects.

All subjects were instructed, prior to study of the passage, to pay particular attention to certain of its contents. Thus, the passage dealt with the lives of three educational psychologists and the subjects were directed to learn six specific points about each of their lives. This constituted the intentional task and responses were scored accordingly. Other information that subjects learned from the task was considered to be incidental learning for which a second score was obtained.

Technical Results

The results were essentially the same for both dependent measures, i.e., the free-recall test and the cued-recall test. The attitude of the experimenter had no overall effect on recall. However, the intentional learning scores were higher when the experimenter exhibited a positive attitude than when he exhibited a negative attitude. In contrast, incidental learning was lower in the positive attitude condition than in the negative attitude condition.

Those subjects who were allowed extra time for study retained more of the information than those subjects who were allowed less time. The data indicated that the extra time was used to learn more of the material the subjects were directed to learn (intentional learning).

The predicted effects of the interaction between experimenter attitude and rehearsal time on performance was not supported.

Educational Implications

At the present state of the science, the results of this study are more appropriately applied to educational research experiments than to the broader areas of application to the classroom. The results imply that experimenter attitude does influence subject performance on an experimental task(s), and has the potential of being an important variable, the effects of which may be unnoticed, in educational research. If the effects of the experimenter's attitude is not carefully controlled it may be a source of contamination of experimental treatments. Such confounding of effects might occur especially if the experimenter had a positive attitude at the beginning of an experiment and changed his attitude to a negative one as the experiment progressed, in which case subjects at the beginning of the experiment would be exposed to a different set of stimuli than the subjects at the end of the experiment. The consequence is differential performance at each phase unrelated to the hypothesized treatments, and the ultimate hiding of the differences in performance at each phase. Standardization of experimental procedures is vital but can be attained through such devices as tape-recorders, computers, and videotape to insure objectivity. While these devices may not eliminate the demand characteristics entirely, they can hold the effect constant over all treatments and subjects.

Teacher attitude may have a similar effect in the classroom but until the appropriate research is conducted any generalizations from the present study must be cautiously qualified. Nevertheless, it seems

reasonable to hypothesize that the teacher's attitude will influence the student's attention to the specific material presented and thus influence his level of performance when tested on that material.

Implications for Further Research

Prior to extensions of research on this effect to school settings, other studies should be conducted with groups, rather than with individuals. If the effect does not occur in experimental groups then generalization to a classroom setting might be very limited. Further research should also be conducted with other dependent measures to determine the generalizability of effects obtained in the present study with meaningful prose. Should both these lines of investigation prove significant then classroom studies would definitely be indicated.

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APPENDIX

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